



technology opportunity

Detection of Chemical Precursors of Explosives

Precursors provide early warning



Researchers at NASA have developed a system and associated method for detecting one or more chemical precursors (components) of a multi-component explosive compound.

Certain selected chemicals associated with terrorist activities are too unstable to be prepared in final form. These chemicals are often prepared as precursor components, to be combined at a time immediately preceding the detonation. One example is a liquid explosive, which usually requires an oxidizer, an energy source, and a chemical or physical mechanism to combine the other components. Detection of the oxidizer (e.g. H_2O_2) or the energy source (e.g. nitromethane) is often possible, but must be performed in a short time interval (e.g., 5–15 seconds) and in an environment with a very small concentration (e.g. 1–100 ppm), because the target chemical(s) is carried in a sealed container.

Technology in Detail

These needs are met by this invention, which provides a system and associated method for detecting one or more chemical precursors (components) of a multi-component explosive compound. Different carbon nanotubes (CNTs) are loaded (by doping, impregnation, coating, or other functionalization process) for detecting of different chemical substances that are the chemical precursors, respectively, if these precursors are present in a gas to which the CNTs are exposed. After exposure to the gas, a measured electrical parameter (e.g. voltage or current that correlate to impedance, conductivity, capacitance, inductance, etc.) changes with time and concentration in a predictable manner if a selected chemical precursor is present, and will approach an asymptotic value promptly after exposure to the precursor.

The measured voltage or current are compared with one or more sequences of their reference values for one or more known target precursor molecules, and a most probable concentration value is estimated for each one, two, or more target molecules. An error value is computed, based on differences of voltage or current for the measured and reference values, using the most probable concentration values. Where the error value is less than a threshold, the system concludes that the target molecule is likely. Presence of one, two, or more target molecules in the gas can be sensed from a single set of measurements.

Patents

This technology has been patented (U.S. Patent 7,623,972).

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about licensing possibilities for this technology for commercial applications.

For More Information

If you would like more information about this technology, please contact:

Pam Beato-Day
Technology Partnerships Division
NASA Ames Research Center
(650) 604-2587, pamela.a.beato-day@nasa.gov